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THE CONCEPT OF SYSTEM IN THE STUDY
OF INTERNATIONAL RELATIONS:
A THEME, WITH VARIATIONS

BY

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled The Concept of System in the Study of International Relations: A Theme, With Variations submitted by John Patrick Lobsinger in partial fulfillment of the requirements for the degree of Master of Arts.

PREFACE

No one involved in the study of political science and international relations in the present period can help but be aware of the gradual replacement, or at least augmentation, of traditional normative political theory by a more factually based empirical theory. Nor is it easy to avoid knowledge of the concept of system, which has had a prominent role in the process of change. Initially introduced by Easton and Kaplan, the system idea has subsequently been developed by a great many authors working with problems of both domestic and international politics.

In the present essay, I shall pursue two somewhat different themes of systems analysis. In the first chapter, I shall be reporting on what began as a vague awareness that the political science uses of system rested on a larger base of natural science doctrine. Such a base did, indeed, exist; its investigation led me into the, for a political scientist, somewhat obscure and complex area of General Systems Theory (G.S.T.), with its heavy emphasis on the biological and physical sciences. The second theme involves the more familiar question of the various uses of system in international relations. In particular, my concern was with how system had actually been applied and with the problem of what unity and order could be found in the various applications; this forms

the second chapter. Finally, since the two areas of inquiry are neither totally similar to each other nor complete and perfect in their own development, a third chapter has been added in the hope that some limited comparison, criticism and synthesis might lead to a clearer and, hopefully, more useful future for systems in international relations.

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CHAPTER ONE

Even the briefest of forays into the subject of General Systems Theory would be remiss if it did not at some point qualify any possible misinterpretations of the subject's rather sweeping title. First, and most important, there is a question of substance: by any commonly accepted definition, G.S.T. is not a theory. As one writer on the subject has put it,

. . . general systems is a point of view rather than a body of doctrine. . . . At the moment it would be presumptuous to claim that there is any clearly defined body of theory which could be identified with the name "general systems."¹

Alternately,

general systems theory is best described not as a theory in the sense that this word is used in science but, rather, as a program or a direction in the contemporary philosophy of science.²

Second, there is a less crucial question of semantics. In a narrow sense, the term General Systems Theory was coined by and refers to the ideas of Ludwig von Bertalanffy. More commonly, it has come to refer to any of several different types of cross-disciplinary theorizing. In the remainder of the present chapter, for example, three of the more important approaches, von Bertalanffy's systems, cybernetics and general behaviour, or 'living', systems, will be discussed. All of these have much in common, such as certain concepts

and more or less common aims, but each retains its own unique points. The reader, then, should remember that G.S.T. represents neither a completed doctrine nor a totally unanimous agreement on how to reach such a conclusion.

von Bertalanffy's Systems

The concept of system is not a new one in the history of thought, but the idea of a general theory of systems would seem to be. Its first explicit formulation would appear to be a series of scholarly articles published in the early 1950's by a biologist, Ludwig von Bertalanffy.³ His position was simple, in aim if not in execution: in response to problems and developments in his own and other disciplines, he proposed at least a partial reorientation of efforts at scientific theorizing and, consequently, scientific research. As a prelude to a more specific discussion of his ideas, a brief digression at this point to discuss von Bertalanffy's, and biology's, history will be useful.

von Bertalanffy recounts⁴ that when he began his career, biologists were split between the mechanist and vitalist positions.

The mechanist procedure essentially was to resolve the living organism into parts and partial processes: . . . The problems of organization of these parts in the service of maintenance of the organism, of regulation after disturbance and the like were either bypassed or, according to the theory known as vitalism, explainable only by the action of soul-like factors, little hobgoblins as it were.⁵

It seemed at the time, and was actually suggested by some, that the final result of the mechanist or analytic approach

would be the reduction of biology to the precepts of physics and chemistry. As a program for research, then and now, this raised many difficulties. The analytic models of classical physics were concerned either with very simple two body causal situations, as in celestial mechanics, or with unorganized or random complexity, as in the properties of gases. Neither of these seemed particularly suitable for the study of organisms, which are essentially very complex but nonetheless organized phenomena. Beyond this basic point, there were other biological problems, such as the apparent teleology of living matter and the increasing order and development evident in evolution, which appeared to directly contradict the laws of physics. What was needed, then, was some sort of compromise position, one which would allow the development of general laws for the peculiarly biological problems, thus denying the mysticism of the vitalists, and which overcame the difficulties of reduction.

The point of breakthrough in von Bertalanffy's quest appears to have come with his development of the idea of open systems. Many of the problems of relating biology to physics and chemistry stem from the fact that the interaction systems in those fields are closed, in the sense that neither matter nor energy can be added to them. As a result, the final equilibria which they attain are completely determined by, and predictable from, their initial conditions. Biological systems, however, are open systems which exist in the midst of continuing processes of importing and excreting materials to

and from their environment. As a result, they do not reach final equilibria; instead, they may achieve steady states, which, though giving the appearance of stability, are in fact an unending process of breakdown and renewal of components. Such steady states are unpredictable from initial conditions alone. They may, though, be predicted from a knowledge of both the initial conditions and the environmental transactions, or, to rephrase it, from a knowledge of the whole system.

The new concept had some rather important consequences in regard to the initial theoretical problems which von Bertalanffy had faced. On the one hand, it completely refuted such evidence as the vitalists had been able to offer. The apparent teleology of some living matter, or the achievement of equal final states from differing initial conditions, could be explained by the effect of environmental flows on the growth of the individual. The apparent contradiction between the second law of thermodynamics, which postulates increasing entropy, or disordering and uniformity of matter, over time, and the increasing order and differentiation of evolutionary phenomena was similarly explainable by the importation of an excess, relative to needs, of matter and energy. On the other hand, the open system concept, while not refuting the reductionist case, showed, as with the case of the second law of thermodynamics just mentioned, the necessity of great caution when applying physical laws to organic phenomena.⁶

As a result of this and other, unspecified work, von Bertalanffy found that many of the problems in biology which

had appeared least scientific could in fact be expressed in terms of a set of mathematical equations. While these are the basis of his general system concept, and thus of great importance here, the discussion of them will be brief and non-mathematical, due to the present writer's mathematical limitations. The verbal presentation should at least give the essence of his thought, as a necessary substitute for a more detailed outline.

The first formula presented is the exponential law, which governs simple geometric growth or decay; with the addition of suitable constants, it can be used to represent growth or decline in many different situations. By the addition of a further term, it becomes the logistic curve or law, which is used where some manner of limit is placed on a process described by the exponential law; an example here would be food resources as a limit on population growth. A third equation, the allometric, describes the competition of separate parts for limited resources. With the inclusion of constants, it can be used to represent the proportional growth of interdependent parts or the shares which individuals or species gain from a common resource pool.

This first group of equations has dealt mainly with changes in the physical dimensions of the system over time; a second group is more concerned with the relationships existing amongst the system components. Wholeness, one of von Bertalanffy's early problems, is represented by an equation wherein a change in any variable necessarily results in a

change in all the others in the system. A limited case of this general equation would be that where interaction decreases with time, leading to the progressive segregation of elements. The opposite of this process would be that where interaction increases, or progressive systematization. The process of development in higher organisms is one of progressive segregation, from a simple and undifferentiated cell acting as a whole to a complex set of organic subsystems which act to some extent independently, though under neural control. This last item, centralization, can also be represented mathematically, by the simple expedient of having the symbol for the central or control part represented in that of each of those which it controls. Finally, accomodation is made for the representation of subsystems, by substituting a variable set of equations, of the type already outlined, for the component or subsystem's symbol, and for open systems, by adding transport terms.⁷

What von Bertalanffy provided, in short, was a set of equations which, by the inclusion of species specific coefficients, could be used to describe certain properties and relationships in most or all biological phenomena. In other words, he had the beginnings of a general theory for certain aspects of biology. It did not deal with all the attributes of its subject matter, nor did it really explain, in a causal sense, anything, but these are not valid reasons for denying it. Celestial mechanics, after all, talks only about the relative positions and movements of the solar system; the

actual nature of the gravitational forces which cause the planetary motions remain to this day an unsolved question.⁸

von Bertalanffy's work would likely have remained the property and concern of biologists only had it not been for two further factors in the development and achievement of his ideas. First, he had seen his concern with wholeness mirrored in the writings of others. Changes in the directions of physics, the growth of gestalt psychology, the switch from micro- to macroanalysis in economics and general trends in philosophy all made him feel that his work had wider import.⁹ Combined with this was a second, more important factor. The mathematical formulations which he had outlined for biology had, in certain cases, exact parallels in other, widely separated disciplines. The exponential law, as the mathematical representation of simple geometric or compound growth, can be used to symbolize these processes in broadly different situations, from the addition of interest to a bank account to the unrestricted increases of animal populations. The logistic law can similarly be applied to populations, to chemical reactions and to some types of economic growth. The allometric equation had already been used by Pareto to describe the distribution of incomes in a national economy.¹⁰

As a result of these similarities of principle and formulation, von Bertalanffy was led to suggest the formation of a new scientific discipline called General Systems Theory. Its aim would be the formation of ". . . a logico-mathematical

field, the subject matter of which is the formulation and deduction of those principles which are valid for 'systems' in general."¹¹ It would form, in effect, a metadiscipline, distinguished from other disciplines not by its concern with some exclusive aspect of empirical reality, but by its desire to form theories relevant to all phenomena, or at least all those which can be formulated as systems. von Bertalanffy's differential equations would no doubt be the base of the new discipline, to be expanded upon in later work.

Such a theory could, depending upon its development, have four very important functions. First, it would provide a means to achieve one of man's long held dreams, the unification of science. This would be done not by reducing all phenomena to basic particles and their laws of interrelationship, but by finding structural or organizational isomorphisms at all levels of existence. Second, and like the more established theories of physical science, it would provide a body of general principles from which the solutions to more specific problems could be deduced, with, of course, the 'engineering' normally required to fit abstract theories to complex actualities. Third, it would have great heuristic or pathfinding value in new and unexplored areas of inquiry. In this connection, ". . . by formulating exact criteria, General System Theory will guard against superficial analogies which are useless in science and harmful in their practical consequences."¹² Finally, G.S.T., as a body of broad principles, would be useful in the training

of scientific generalists who, amongst other things, would presumably carry out the first three processes mentioned.¹³

To summarize, the narrower sense of General System Theory, as initially formulated and as outlined here, appears to be a reasonably straightforward matter. Its factual base consists of a number of widely applicable verbal concepts and relationships and their mathematical expressions. The latter are particularly important, since they allow the comparison and classification of otherwise qualitatively different phenomena. From this base, it suggested a future course of development aimed at, ideally, a set of related theories encompassing all organized matter. Like a good system, however, the course of G.S.T. was not entirely predictable, open as it was to other, external intellectual influences. One of these was the somewhat parallel field of cybernetics, to be discussed next.

Cybernetics

von Bertalanffy, it turned out, was not entirely alone in his ideas. In the period when he was working them out, several other groups in various disciplines were working separately on narrower problems which, when settled, suggested developments strikingly similar to his own. Brought together, in part, by the scientific 'push' of the Second World War, these other efforts culminated in the postwar discipline of cybernetics, or the science of adaptive mechanisms.

Adaptive, or self-controlled, machines, like the idea

of system, were not new. Subsequent inquiry has shown examples invented in the nineteenth and even the fourteenth centuries.¹⁴ As with systems, what was new and important about cybernetics was not its basic ideas, but the thought that they might be formulated as general principles of broad applicability. These basic principles are few and can be outlined quite briefly. They are, in the order of their presentation: feedback, homeostasis, the black box, information and the adaptive machine.

Feedback, in its simplest sense, means nothing more than mutual interdependence of variables. That is, if a variable X determines a variable Y, then there is no feedback. But if a change in X causes a change in Y and this change in Y in return causes a change in X and so on, then feedback can be said to exist.¹⁵ More common definitions of feedback usually imply some manner of control function, in which one of the interdependent variables is concerned with regulating the others. The favorite example here is a thermostat regulating temperature: the gradual heat loss of a room causes changes in the bimetal strip in the thermostat, which in turn starts a furnace which adds heat to the room; the effect of the additional heat is eventually fed back to the thermostat which, when the desired temperature is reached, turns off the furnace.

Most examples of regulators, like the thermostat, illustrate both positive and negative feedback. In the negative variety, interdependence is used to dampen or limit the

the changes of a specified variable and thus keep it within a preset range of variance; this is shown by the thermostat turning off the furnace. The opposite or positive feedback increases the variable's value; this is seen when the loss of room temperature is fed back to the bimetal strip, causing the furnace to start adding heat. These regulatory examples, however, should not be overstressed, since there are many cases in nature where, as with birth rates, regulation or limits to the variance may be either unintentional or nonexistent.

The product of regulatory feedback is the homeostatic or steady state. Put simply, the self-controlling machine regulates the responses of some or all of its parts to disturbances, either internal or external, so as to maintain itself. If only one time-finite disturbance is faced, then the machine will gradually reach a stable equilibrium. But if, as is usually the case, the machine exists in a fluctuating environment, then it will be in a constant process of changing or balancing its parts. The similarity of this to von Bertalanffy's steady state is striking, but there is one notable difference. In the open system, the resulting stable situation or steady state may, in theory, be anything, as determined by the environmental flows; in homeostasis, the machine attempts to maintain a predetermined stable situation by changing its own parts to counteract the environmental effects. In short, the steady state may go anywhere, but the homeostatic system has set limits, beyond

which it fails or dies.

The black box is a methodological device rather than a substantive concept. Often used in electrical engineering, it has been picked up by Ashby as a useful tool for cybernetic and general system analysis. In many machine or system situations, the researcher is faced with a large number of variables which are interdependent, or show feedback. If the number is more than a few, then the problems of determining causal sequences becomes very difficult, if not impossible. Rather than go to such lengths, Ashby suggests that the researcher treat the situation as a closed box whose internal working are determined by making measurable inputs to the box and then recording its outputs. After a series of such steps, one attempts to deduce regularity or determination from the relations between input and output.¹⁶ In other words, one treats the system as a whole or as a type of stimulus-response problem.

The concept of information may or may not be included in cybernetics, depending upon the individual author. Though it forms a separate field of research, certain types of automata depend upon its findings and so it might be given brief mention here. As an area of scientific inquiry, information theory is not concerned with the normal sense of the term information, as semantic meaning, but with the symbolic encodation of such meaning and its subsequent storage, manipulation and transmission. As a spinoff of the communications and computing technologies of the present day, it is

particularly interested in performing the above operations successfully on non-random patterns of signals conducted electrically in channels which contain some measure of unavoidable random static or noise. It is in this narrow sense of communication that information theory, by providing the means by which parts of automata relate to each other, becomes relevant to cybernetics. It is not, to repeat, concerned with the conventional senses of meaning; this is something which must be provided by the agent employing the communication channels.

The adaptive machine is that which, building upon the processes set forth above, is able to respond variably to some part of its environment or situation. In order to do so, it must have provision for at least a basic set of steps. First, it must be capable of perceiving differences in that part of its environment to which it is to respond; this is done by receptors responsive to any of the five basic human senses or to electrical or other signals. Second, it must decide if the value obtained in the first step is within its allowable limits. If it is not, then it must, third, choose and put into action an effector which will work on the relevant part of the environment so as to bring it within the allowable limits. In the simplest machines, the perceiving and deciding stages may be combined. In more complicated cases, a whole range of perceivers may be included and be coupled with a more extensive memory of possible situations and responses. The highest order of machine,

which is more aim than actuality at the moment, is that which can not only react within its programmed set of responses, but which can also learn in the sense of deleting unsuccessful responses and recombining old ones to form new and more useful ones. It is this capability, developed to a fairly high order in the human brain, which has made man a creator and controller of machines. Pride in past accomplishments must not, however, prevent the perception of remaining problems; the penalties for failure to adapt are too harsh and irrevocable.

The connection between the foregoing and G.S.T. proper should by now be obvious. Adaptive or self-controlled mechanisms are clearly systems of interacting elements which manifest organization. They are likely to be open systems which respond to at least part of their environment; their responses will probably be homeostatic, and, as such, form a limited case of the steady state. As the black box concept suggests, they may be susceptible to treatment as wholes. Finally, they may, in principle, be given the same sort of mathematical expression and treatment which von Bertalanffy gave to systems.¹⁷ These overlaps are recognized not only by the inclusion of the cyberneticists within the greater systems movement, but also by the recognition of a field of systems technology. This area, dealing with the design of machines and with fitting them to their human operators and customers, can be viewed as the applied science section of the systems discipline.¹⁸

Living Systems

The last of the threads of G.S.T. to be discussed is also the last, or most recently, developed. Unlike the two previously discussed areas, it is not strictly the result of the generalization of ideas and principles discovered in more specific scientific work. Instead, its creator, James G. Miller, has taken concepts from G.S.T., cybernetics, biology and other fields and expanded and integrated them into what he sees as a beginning for a general theory of behavior.¹⁹ It is, of the three areas treated here, the most analogical and the least scientifically developed.

As a prelude to the ideas of living systems developed by Miller, it will be useful to quickly mention the notion of hierarchies of systems. In an early article,²⁰ Boulding suggested two ways of pursuing the general systems aim. One was to pick out, and develop general theories for, such broad phenomena as growth, interaction and communication. A second approach would be to outline various levels of systems and then develop theories for each. To illustrate the latter, he set down seven basic levels:²¹

- 1) the determinate physical system, from atomic physics and chemistry to clocks and the solar system;
- 2) the self-controlled or cybernetic physical system, as already discussed;
- 3) the cell or open system, which maintains and reproduces itself by the through-put of environmental

materials;

- 4) the plant system, which is the first to include division of labor and genetic or 'blueprinted' growth;
- 5) the animal system, identified by mobility, self-awareness and beginning communication;
- 6) the human system, marked by self-consciousness and the extensive use of symbols;
- 7) the social system.

Miller's attention seems to be focused on the last three of these levels, though he might conceivably include some plants and automata as well. His aim is to outline the concepts both common and crucial to all phenomena at these levels; to this end, he provides over eighty double column pages of reasonably rigorous definitions. The first half of them deal mainly with basic concepts of analysis, such as variable and structure, and with the basic ideas of G.S.T. and cybernetics already discussed in this paper.²² Though useful for its amplifications of these basics, it need not concern us here. The second, and more original, half sets out what he considers to be the critical subsystems and the overall system processes of all living systems.

An initial distinction is made for both subsystems and processes, as to whether they deal with physical matter-energy or information. The critical subsystems processing the former are:

- 1) ingestor: brings in matter-energy necessary for survival of the system from the environment;

- 2) distributor: moves this matter-energy within the system to points of need;
- 3) decomposer: breaks externally formed matter-energy down into internally usable forms;
- 4) producer: puts matter-energy into new forms for system uses, such as repair or replacement of components, or for output into the environment;
- 5) matter-energy storage;
- 6) extruder: moves unnecessary system products or wastes into the environment;
- 7) motor: translates internal matter-energy into productive force or movement;
- 8) supporter: maintains the predetermined spatial relationships of other subsystems, as with skeletons.²³

Two further subsystems deal with both matter-energy and information. The function of the reproducer should be obvious. The function of the boundary subsystem is to define the system's limits and, more crucial, to restrict system imports and exports to established and presumably controlled channels.

The critical information processing subsystems have some parallels in those for matter-energy, as well as having some unique functions:

- 1) input transducer: receives information from the environment and puts it into a suitable form for internal physical transmission; it has a within-system parallel, the internal transducer, for internally

generated messages;

- 2) channel and net: internal routes and junctions form a net for distribution of messages;
- 3) decoder: gives semantic meaning to received messages;
- 4) associator: is the beginning of learning or knowledge; it recognizes relationships of patterns between separate bits of information;
- 5) memory: information storage;
- 6) decider: controls the whole system;
- 7) encoder: puts outbound messages into a form understandable by and acceptable to the environment;
- 8) output transducer: transfers information to the environment;²⁴

In addition to these crucial subsystems, Miller suggests that all systems will have at least six necessary multi-subsystem or whole system processes:

- 1) process relations between inputs and outputs: this is essentially the black box concept and does not appear to constitute a distinctive process, though it is listed as such;
- 2) systems maintain matter-energy and information input, internal process and output variables in steady states by the actions of subsystems;
- 3) systems may have multi-subsystem adjustment processes for achieving the steady states of 2);
- 4) systems may evolve through reproduction to higher or lower levels;

5) systems may grow and become more cohesive and integrated;

6) systems may decay and terminate.²⁵

The second and third categories above appear to be system maintenance processes; the fifth and sixth should be familiar from points discussed earlier in this paper. Needless to say, all of the points, both critical subsystems and processes, outlined by Miller will be relevant to subsystems as well as to systems, a subsystem being, in essence, a system which is also a part of a larger system.

Only two things need to be added to this very brief and abstracted summary of Miller's work. First, lest he be accused of doing nothing more than creating another enormously complex classification scheme, it should be pointed out that he has set forth over one hundred and fifty cross-level hypotheses as a potential start on the work necessary to find the many relationships between concepts and across levels.²⁶ Second, and as a final comment, the earlier mention of the highly analogical nature of Miller's work might be repeated, with an addition as to its very organismic source and origin.

Further Developments

It was likely inevitable that the passage of time should bring changes to the systems movement. But, inevitable or not, the favorable response with which the systems ideas were received and the consequent influx of new and

varied practitioners has meant an increasing diversity within the movement. Many of the newcomers have seized upon the heuristic function of G.S.T. in attempting to operationalize it within their own specific disciplines; the remainder of this paper is in part a survey within one small area of some of these attempts. Others have continued in the more general, theoretical vein: work has been done on strengthening the philosophical base of the movement, on extending the mathematical formulations and on increasing the number of system functions and processes to be considered.

No doubt because of their great variety, these many efforts may leave the reader feeling slightly unsatisfied. There are points where G.S.T. appears to accept as a part of itself any attempt at interdisciplinary theorizing or at applying mathematics in a previously unquantified area. Much of the conceptual rigor which was promised seems to have lapsed or been forgotten; often, the only thing which some pieces seem to have in common is an interest in 'systems,' in the broadest and vaguest sense of the term. Much of this is unavoidable in a growing area of such encyclopedic scope. To eliminate it would be both impossible and undesirable, since it would entail the abolition of a great deal of creative and potentially useful work. What is needed, instead, is a continuing five or ten year review which would critically analyze, classify and compare both central theory and surrounding applications, in both their qualitative and quantitative aspects. Such a secondary analysis of the move-

ment would have obvious summary benefits for the often hard-pressed practitioner. It could also be a major and useful step in the direction of fulfilling G.S.T.'s educational function, which has thus far been largely left untended.

CHAPTER TWO

Having discussed some of the more general variations on the systems theme which make up General Systems Theory, it remains to investigate the more specific variations which have been employed in the study of international relations. These provide a particularly interesting contrast with the more general ideas, for they are the product of a somewhat separate development, having been only partially influenced by the broader theory. They are, in effect, as much a parallel growth as a subsequent evolution of G.S.T.

Three sorts of antecedent can be seen for the current international relations uses of system. For the first, it can be plausibly argued that the things which systems approaches currently attempt to do are very much within the tradition of the discipline. Thus, holistic descriptions of actors, studies of interactions, rather than of actors, and sweeping generalizations about all international relations are not new. Morgenthau's theory of international politics²⁷ and Herz's projections of the effect of the introduction of nuclear weapons²⁸ are both examples of traditionalistic analysis involving systems. Similar examples may be found in studies of international law and morality.²⁹ What distinguishes modern systems uses, or at least those to be covered here, is not, then, their basic concepts, but

their approach to knowledge, particularly their avowed aim of scientific knowledge.

The second source of systems ideas was the G.S.T. movement already discussed. Started by Kaplan and carried on by others, this borrowing trend has had a significant, though not exclusive, influence; its course and consequences will form a large part of what follows in this chapter.

Finally, the recent use of system has been furthered by Waltz's perceptive reanalysis and classification of some traditionally great works of political philosophy.³⁰ Concerned with the causes of war, he divides past attempts at explanation into three groups. The nature of man, the nature of his states, or political organizations, and the nature or conditions of the interaction of each form three levels of analysis which have been more or less standard ever since. Briefly, his third, or system, image, seeks to point out that conflict might result from a style of interaction which allows individual actors to be the final adjudicators of their interests. Thus, the most pure or moral actors might come into conflict through fear, misperception or differing judgments of morality.

In short, tradition, infusion and reanalysis, aided by a good measure of innovation, have all interacted to bring system in international relations to its present state. The account which follows, however, will not necessarily reflect this background; rather, it will focus on those authors and works which have at least some relevance to

the trend of empirical theory mentioned at the beginning of this paper. The reasons for this are partly economic and partly intellectual: economic in that a discussion of all the research which focuses on interaction would be impossibly large, intellectual in that the empirical theory movement is judged by some to be the most serious and important part of the discipline. The discussion will be split into two parts, following Goodman's³¹ very basic terms of system-as-description and system-as-explanation. The former includes the description of systems and their attributes or characteristics; the latter covers attempts, such as Waltz's, to explain some part of international relations by reference to such system attributes.

Descriptive Systems in International Relations

One of the earliest and, by number of citations, best known of the current theories of international systems is Morton Kaplan's System and Process in International Politics.³² Rather than presenting a single theory, this work contains aspects of four theories. Part One of the book deals with systems analysis; it contains a chapter outlining the basic concepts of system, a chapter applying these to six international systems and a chapter outlining the possible effects of system types on national actor behaviour. Part Two deals with outlining and applying to the international system three basic system processes: integration, disintegration and regulation. Part Three is an attempt

to clarify the question of values, particularly as it applies to the problem of national goals. Part Four seeks to apply game theory to problems of strategy, or national actor decision-making. Of these four, only the first two are of interest in the present inquiry.

Kaplan's first section, on system analysis, can only be viewed as an object lesson in how not to write a theoretical exercise. He begins by setting out and defining a number of basic system concepts, apparently drawn from Ashby's Design for a Brain. These include system and environment, feedback and interdependence (coupling) and equilibrium and stability; all are defined conventionally, with normal system examples. Following this, he approaches his assigned topic and outlines what he feels to be the major variables of international systems. The essential rules of the system describe general relationships between actors; they specify characteristic behaviour. The transformation rules apparently give the conditions under which essential behaviour will change. The actor classificatory variables specify the nature of the system elements; the capability variables give the capability of actors to carry out certain types of actions. Finally, the information variables seem to refer to the actor's knowledge of its own and possible opponent's possibilities for action. None of these, it is important to note, is defined operationally, nor is any attempt made to relate them to the earlier defined systems concepts.

Two further sections occupy the remainder of the first chapter. The first discusses the qualities which make a system political; its relation to the rest of the chapter is unclear, but it does lead Kaplan into the interesting position, for the author of a book on international politics, of suggesting that the international system is not political.³³ The final section outlines briefly the idea of role analysis and suggests, without development or evidence, that it applies to international systems.

Kaplan's second chapter sets out the details of six international systems. Surprisingly, almost none of the theoretical concepts outlined in the first chapter are used in this exercise. Of the international system variables, the actor classificatory variables are used in all the systems, the essential rules are given for four and the transformation rules for one. The capability and information variables are forgotten. The more general concepts of systems analysis are ignored or used inconsistently,³⁴ as are those of role analysis.

None of the six models makes any sense in terms of a unified and coherent set of theoretical concepts. Rather than starting from a consistent base, such as with varying numbers of actors with varying characteristics and behaviours and then trying to find patterns in their interactions, he simply postulates the patterns and then discusses some of their ramifications. The models do, however, make sense as theoretically uncontrolled abstractions and generaliza-

tions from past experience or as extrapolations from domestic to international politics. Thus, the balance of power system, the most extensively discussed of the models, is essentially a generalization of aspects of the European balance system of the eighteenth and nineteenth centuries. The loose bipolar system, which gets the second largest amount of coverage, simply abstracts from the Cold War as it had progressed to 1957, the book's publication date. In this connection, it is interesting to note that some of the essential behaviours which he postulated, such as those for non-bloc members, have simply not occurred and that changes in the real system have occurred, such as the partial breakup of the Soviet bloc, which cannot really be explained by his postulates. There is, of course, no sin in incorrect prediction, but the facts do call into question the essentiality of his essential rules.

Of the remaining systems, one, the tight bipolar, deals with the consequences of stronger controls by bloc leaders over smaller actors. Two, the hierarchical and the universal, treat briefly some of the effects of the formation of an international government; these, in general, project the growth of parallels of situations existing in domestic politics. The last system, the unit veto, discusses the effect of all actors having extremely destructive nuclear style weapons. It seems significant that the treatment given these last four systems, none of which has ever existed, is much briefer than that of the balance of power

and loose bipolar systems, both of which do have an historical basis. There is, again, no sin in the kind of historical generalization which seems to be behind Kaplan's systems, but it is misleading when this is combined with the kind of scientific model building which he attempts in his first chapter.

Since the major concerns of the present paper are the constitution and operation of systems, it seems reasonable to exclude Kaplan's third chapter, where he relates system types to actor behaviours, rather than the other way around, and proceed to his Part Two, which discusses the system processes of regulation, integration and disintegration. Regulation he defines as ". . . the process by means of which a system attempts to maintain or preserve its identity over time as it adapts to changing conditions."³⁵ Integration and disintegration are similar regulatory acts involving, respectively, joining with or separating from, other units or systems in the face of similar needs or problems. In the discussion of these, one brief chapter on regulation makes a few generalizations as to the conditions of decision-making units which make for greater flexibility and adaptiveness and thus success in facing new problems. The general impression is that routinized and specialized division of labour under an overall co-ordinating body is the most flexible. This is followed by a slightly longer chapter which sets out nine hypotheses relating to the integration and disintegration of decision-making units. These

relate such factors as role functions, unit flexibility, insulation or separation of roles and actors and length of joint service to the overall processes. Finally, a third chapter applying the integration hypotheses to the various systems of Part One and developing specific, if brief, case studies ends the section.

Kaplan's discussion of system processes is useful as far as it goes. But it must be read and interpreted with caution, for it contains some unannounced and potentially misleading changes in terms. The problem lies in deciding, first, which system - the 'whole' system of all actors, the national actor systems or some in between or 'partial' supranational system - and, second, which definition of a process he is referring to at any given moment. Only in two of his whole systems of Part One, the universal and the hierarchical, is there sufficient integration to allow the possibility of regulation and disintegration, as he defines these processes. In the four remaining systems, the three processes are only possible amongst partial systems or within the national actor systems themselves. Unfortunately, he goes on to speak of the integration and disintegration of the four whole systems, changing his meaning to something approximating the continuance or breakdown of the system in question.³⁶ While this may be a valid use of the terms, it signifies quite different processes from those initially set down. Similarly, he speaks of the individual efforts of national actors to control their environments as system

regulatory.³⁷ As will be seen later, this assertion's validity is very important to international systems analysis; for the moment, however, it is sufficient to note that it implies a different concept of regulation from that originally outlined.

System and Process, then, is a less than ideal effort. No matter how high or important its aims, their execution leaves much to be desired. The transition it makes from general systems ideas to abstract international systems model and to specific international systems is a confused path, fraught with danger at every step. Similarly, the operationalization of Kaplan's concepts of role and their relationship to the concepts of system leave one intellectually dissatisfied. Abetting, and perhaps even causing, all of this is a literary style which, as Boulding points out,³⁸ is so poor as to actually discourage present and potential readers.

But to criticize Kaplan's book is not to deny its effects. It is probably more responsible than any other single work for the consciousness of international systems which presently exists in the field of international relations. Beyond this, it has also inspired a more limited amount of theory and research activities. Thus, Masters has suggested a multi-bloc system model similar to Kaplan's balance of power, but differing in that the basic actors are supranational blocs rather than national states.³⁹ Because it follows Kaplan very closely, this article does not add any-

thing to the stock of ideal system types. But it does give a more detailed account of the actual, as opposed to ideal, actor behaviours possible when the type of actor is changed and when a nuclear capability is added. Another article, by Hanrieder, attempts to find a mid-position between Kaplan's bipolar and Master's multi-bloc systems.⁴⁰ Arguing that neither is sufficient to describe the current international system, he urges the use of a transitional model which would recognize several coexisting systems differentiated substantively on the basis of functional or issue areas and structurally by the division of power in each such area. There might be a symmetrical, or bipolar, nuclear weapons issue area or a hetero-symmetrical prestige area, with the latter division recognizing both major powers as well as the 'third world.' Other possibilities would be asymmetrical and hetero-assymmetrical divisions, where one actor has, respectively, a majority or a plurality over all others in the specific issue area.

In a similar way, Merritt's model of an imperial system is a combination of significant improvements on some basic Kaplan points.⁴¹ The actors in the system are a dominant subsystem, or metropolitan country, and any number of dependent subsystems, or colonies. The structure of the system is defined by relationships of domination and submission, or power, between the two types. These relationships are operationalized or indicated by: first, the direction of policy decisions, or rule making; second, by the

direction of communication flows, or attention; and third, as the direction of loyalties and identification. In the imperial system, policy flows down from the dominant subsystem, attention and loyalties flow up to it. Merritt also discusses a number of factors, such as increasing interaction amongst dependent subsystems, which could change or transform the system and the directions, such as towards integration, which such changes might take.

His model, then, includes counterparts of Kaplan's structure, or essential rules, and transformation rules, but excludes the three types of actor classification variables. Merritt's model is the stronger for several reasons, not the least of which is the clarity with which he specifies and differentiates his variables. A major substantive weakness in Kaplan's analysis is the unjustifiably teleological bias he gives some of his systems by including amongst their defining behaviours some negative injunctions against actions which could change the system.⁴² Merritt, on the other hand, defines his system solely by generalizations from actual historical behaviour and places the factors which might result in change in an analytically distinct category. His exclusion of any actor detail is beneficial in that it emphasizes the system or relationship variables, but it is likely to leave unsatisfied those who wish either historical detail or an explanation of why the system acts as it does.

Another system model, by Rosecrance, almost completely

reverses Merritt's ratio of system to actor variables.⁴³

Like Kaplan, Rosecrance borrowed his model from Ashby's cybernetic work, though he used a different source book. But, in spite of the continuity in Ashby's writing, there is little in common in Kaplan's and Rosecrance's models.

The specific inspiration for Rosecrance was the discussion of system regulation in Introduction to Cybernetics. His borrowings were rather modest, however, for he took only a suggestion or analogy, rather than an entire technical model.. The major distinctions in his model are four. A national actor creates a disturbance in the system or makes demands; the effect or outcome is determined by the available supply of whatever is being demanded, as set by an environmental table, and by the extent of regulatory action within the system. To this basic action and reaction model is appended a three part classification of national characteristics which cause or explain system disturbances: the ethos, or direction or nature, of national elite values; the nature and extent of the elite's control over the nation; and the resources which the nation has for pursuing its goals or creating disturbances.⁴⁴ The only systemic variable in the model, then, is the regulatory function, which is operationalized as the supranational and international organizations, such as alliances and the U. N., which are formed by national actors to try and control disturbances.

Rosecrance's book is open to criticism on two broad points. First, his interpretation of actor initiatives as

system regulatory, like Kaplan's, creates difficulties which will be discussed in the final chapter. Second, his model is unlikely to be of much use to other analysts in the immediate future. Rosecrance has already applied it to the last two hundred years of Western international relations in a broad, interpretive way and has specified his variables in such a way that more detailed studies are unlikely.

At this point, brief mention might be given to two further examples of political systems analysis which, though developed for the study of non-international systems, have been suggested as relevant to international relations. For the first, David Easton has suggested that his theoretical analysis of politics might be as useful in studying the international political system as he feels it to be for national politics.⁴⁵ To this end, he argues the existence of an international society with authorities and regime for allocating values. The possibilities for his approach would seem to be two. First, there are international organizations, such as the U. N. and its specialized agencies, which conform to Easton's sense of a political system. But even the most enthusiastic student of such institutions would not suggest that they allocate all or even the critical values of international life. Given this fact, one may, second, take Easton's model to the real sources of allocation, the national initiatives and the occasional bi- and multilateral conference. But such a definition of system would be quite different from that implied elsewhere by

Easton⁴⁶ and would necessitate the unpleasant and inconvenient effort of restating for each new system the particular members, stresses supports and other Eastonian functions operative in it. This may, in fact, be the only sort of system possible in international relations, but one hopes not; in any case, the general question will be returned to later in the essay.

Somewhat similarly to Easton, Herbert J. Spiro suggests that international relations are gradually being replaced by the world politics of a global system.⁴⁷ In support of this contention, he points out changes in political style, in the role of the United Nations and international law and in the actors of the system. His only theoretical contribution is a classification of political styles, which groups specific and more generalized issues of a system according to their position on procedural-substantive and fundamental-circumstantial polar scales.⁴⁸ While this might conceivably be a useful means of characterizing the behaviours of system components, it cannot be viewed as a total answer to the problems of international political systems theory.⁴⁹

All of the foregoing modes and models of international systems analysis, in spite of their obvious differences, have one point in common. All give the impression, either implicitly or explicitly, of dealing with whole systems made up of all the national actors extant at a given moment. Another trend of criticism and construction in the area, however, argues that this approach is insufficient for de-

scribing the actualities of international relations. To round out the discussion, it feels that the treatment of such dominant or whole systems must be supplemented by one of partial, regional or subordinate systems.

Binder was the first in this trend, with his article on the Middle East as a subordinate system;⁵⁰ he was followed by Brecher, writing on a possible Southern Asian system.⁵¹ More recently, Young has written on the difficulties of relating such systems to the dominant powers system.⁵² Since all of these have given greater consideration to current situations and behaviours, their theoretical contributions, beyond the initial regional or subordinate system idea, have been fairly low.

A somewhat different approach to the problem of breaking down whole systems into more realistic components is given by Rosenau's issue area concept,⁵³ already seen briefly in the previously cited article by Hanrieder. In Rosenau's own words,

. . . we shall distinguish between horizontal and vertical political systems. A horizontal system is conceived to be a set of interdependent procedures through which a geographic unit (e.g., a city, state or nation) or a functional institution (e.g., a party, legislature, or bureaucracy) allocates values and mobilizes support in a broad range of issue areas. A vertical system, on the other hand, is conceived to encompass a set of interdependent procedures whereby a cluster of values within an issue area is allocated by either a single horizontal system or a fusion of horizontal systems. The number of vertical systems operative at any one time is conceived to be quite variable and dependent on the purposes of analysis.⁵⁴

Such vertical systems might be defined by narrow issues,

such as reduction of nuclear delivery systems or air traffic agreements, or on the broader value clusters or issue areas, such as territory and non-human resources, which Rosenau mentions.⁵⁵ Either way, it seems likely that there would be significant variation in the actors represented and the behaviours manifested. Overall, the issue area concept is not entirely new, since it has some traditional status in the example of functional international organizations; only its theoretical use is new.

Russett's recent empirical study of regionalism is relevant to aspects of both the approaches just outlined.⁵⁶ By factor analyzing data on socio-cultural variables, U. N. voting behaviour, membership in international organizations, trade patterns and physical proximity, he is able to delineate a number of homogeneous or interdependent regions or groupings of states. At least one of these, based on trade patterns, can be seen as a functional definition of partial systems. The book makes a valuable critical contribution in pointing out, first, that an infinite number of regions may be outlined by varying the defining characteristics and, second, that no single set of definitions is likely to satisfy all requirements.

A number of authors whose writings are on or relevant to international systems, and who do not fit into either of the two rough groups already discussed, remain to be treated before concluding this section of the chapter. The first of these, Rudolph Rummel, is better known for his fac-

tor analyses of national characteristics. But he has recently outlined a program of research which can only be classified as systemic.⁵⁷ Building upon his national data, he proposes to factor analyze the differences or distances between pairs of nations, or dyads, on a large number of dimensions; such a relational distance becomes a systemic variable by virtue of its position between, but not of, each actor. Since the variables chosen for analysis will include both structural and behavioural types, the results achieved will hopefully give some indication of what sorts of national differences relate to different types of actions. But such conclusions must await the completion of the project and publication of its results.

The second author in this group is the third overall to be inspired by cybernetics. Like the others, Deutsch has a different source of cybernetic ideas and a different interpretation of their implications for political research.⁵⁸ Given his apparent awareness of the more technically or physical science oriented aspects of cybernetics, it is not overly surprising that he chooses to emphasize the concept of information and the communications systems based upon it.

A point of explanation and caution should be raised here. As was seen earlier in this essay, scientific information theory has been primarily concerned with transferring, manipulating and storing binary units or bits of information, usually electrical signals, against a background of static or random noise. These bits are only secondarily

knowledge or information as these terms are conventionally used. Deutsch, on the other hand, uses cybernetics, including information, analogically rather than technically and is very much concerned with knowledge and semantic meaning. In his concept, all facts and theories are information; as such, information and communications systems are a necessary precondition of society and politics. The modern decision-maker, precluded from experiencing personally all the facets of political life, is almost totally dependent upon the information accumulated and processed by his organization.

From this base of information as knowledge, Deutsch discusses some of the other cybernetic concepts and their possibilities for political research. A system is defined, to a large extent, by the information or theories held by its component individuals and groups and the facts of their interaction. The stability of a society will depend upon the information held by its decision-makers, on feedback from society to political elite and upon the opportunities and capabilities for social and elite learning. The role of the communication system within the decision-making system, what facts and interpretations it chooses to filter out or pass on, is an important intervening variable in these processes.

Only parts of Deutsch's work appear immediately relevant to international systems. Since much of it is keyed to the analysis of decision-making systems, it suffers the same difficulties mentioned in the earlier discussion of

Easton. The fact remains that it is very difficult to locate in international relations examples of groups which exhibit both continuity and either cybernetic functions or authoritative allocations. Deutsch's idea of defining a system by its various transactions does have some appeal, though. As was seen earlier, Merritt, a student of Deutsch, outlined his imperial system type in terms of the directions of transactions in policy, attention and loyalty. Similarly, Brams distinguishes two units of analysis at the system level: the national components and the relations between them.⁵⁹ His article tests the salience or relatedness of nations in terms of their exchanges of diplomats, trade and shared memberships in international organizations; on the basis of this data, he attempts to find groups or international subsystems which have commonly salient members. The second half of the project points to the current importance of geographic proximity and former colonial ties as the basis of such subsystems but also echoes Russett on the variety of groupings possible when different criteria of selection are used.

The last author on descriptive systems, Charles A. McClelland, was amongst the first to use the concept of system in international relations. While his writings on the subject have varied,⁶⁰ his main contribution seems to be the idea of interaction analysis.⁶¹ In effect, this is a form of transaction analysis, but one which excludes the aggregation of ordinary and routine exchanges, in the manner

of Brams, in favour of the detailed examination of international crises. The purposes of such historical investigation are twofold:

- 1) to see if any common patterns of events exist in the specific actions and responses of several or many crises, and
- 2) to see what, if any, relationship exists between the specific crisis subsystem and the more general system.⁶²

The second of these is somewhat vaguely specified, but it appears to refer to the interplay of specific crisis events and overall relationships amongst groups of actors. In terms of operationalization and testing, this approach is only slowly being picked up, but a few results are now beginning to appear.⁶³

Systems Explanations in International Relations

The desire for explanation is a major aspect of most sciences, be they physics or the empirical theory movement in political science. The reason for attempting to use international system factors in this quest is equally simple. That is, the same logic which leads us to infer that differences in individuals and nations may have causal significance for events applies to international systems. The application of this logic, however, very quickly runs into difficulties, for the simple reason that very little has been done on distinguishing international systems in systemic terms. This statement may appear strange in view of

the preceding twenty pages on different systems, but it may be remembered that most of those discussed were defined in terms of national characteristics and behaviours. Their explanatory emphasis, then, is presumably national.

This weakness, of course, should not be mistaken for a total absence of effort. Waltz, for instance, suggests the absence of a supreme authority or the anarchical nature of the system as a potential cause of war.⁶⁴ However persuasive, though, this contains several difficulties. First, the absence of something cannot, strictly speaking, be listed as a scientific cause. Second, since this factor exists for all international systems at all times, it is of no use in explaining any given, specific event.

Similarly, Kaplan's six systems are implicitly differentiated in terms of their number of essential actors. Thus, his balance of power and unit veto systems presuppose several actors, his bipolar systems are by definition made up of two essential actors and his hierarchical and universal systems contain only one essential actor.⁶⁵ Unfortunately, this systemic variable is neither recognized nor its effects pursued in his analysis. It has, though, been suggested as an independent variable affecting system stability by Deutsch and Singer.⁶⁶ Singer and Small have also given this latter relationship partial empirical testing in their study of alliances as correlates of war.⁶⁷

The transactionalist approaches outlined might have - and in one case do have - similar explanatory uses. The

aggregated transactions given by Brams and Merritt represent types of systemic relationships between nations which could easily affect subsequent behaviour.⁶⁸ In much the same way, Russett actually does use his measures of regional homogeneity and interdependence as independent or causal variables in a discussion of the possibilities for war and integration in various regions.⁶⁹

Finally, Rummel's inter-nation difference or distance measures, outlined earlier, provide a type of systemic variable which indicates the interactions of nations in more areas than are covered by studies of overt behaviour and at a more specific level of detail than has heretofore been usual for the transactionalist approach.

In any field, explanation is inextricably tied to description, for the simple reason that one cannot have an explanatory factor unless there is some describable phenomena from which to derive it. But in system terms, not all of the schools of description have been represented in the foregoing examples of systems explanations. Those who favour a component definition have been excluded for the obvious reason that their unit of analysis entails a different level of explanation. Functionalist approaches to international systems have been suggested, but their explanatory ramifications have not really been pursued. The transactions approach has been used, as has the whole system school, as represented by Waltz, and the regional school, as seen in Russett. The partial or regional approach is taken to its

extreme form in Rummel's dyadic or two nation systems.

All of the various factors outlined briefly here constitute useful contributions to the study of international relations and systems. But they by no means exhaust the possibilities inherent in a systems approach. A better understanding of these possibilities will be sought in the next, and final, chapter.

CHAPTER THREE

To recount very briefly, Chapter One of this essay treated generally the ideas of General Systems Theory and Chapter Two discussed the uses to which the idea of system has been put in the study of international relations. For the most part, these accounts have been necessarily brief and descriptive, though criticism has been added where relevant. Both chapters reflect a two part division in the paper, first, in terms of time, between past accomplishments and future research directions, and, second, between the two areas of systems efforts. Both of these divisions will be removed in the present chapter.

The focus of the present essay is the use of system in international relations and so the future discussed in this chapter will be that of international systems approaches. In doing this, however, the separation of G.S.T. and international systems ideas will be eliminated by outlining a very general approach in terms of some G.S.T. concepts and then applying this to the international field. This essentially descriptive section will then be followed by one on the possibilities for systems explanations and, finally, by a short summation of the ideas of international systems and their interaction with those of G.S.T.

Systems Descriptions

The most basic concept of G.S.T., and the starting point for any application of it, is that of system itself, defined as ". . . a set of objects together with relationships between the objects and between their attributes."⁷⁰ Clearly, a specification of both objects and relationships is necessary for an adequate definition of a system. Objects are obviously a necessary precondition for a system; beyond this, the nature of specific objects, as defined by their attributes, may determine the types of system or relationship which can be formed by them. Equally, a statement of relationships is necessary, since these indicate the ways particular objects are joined together; similar objects might be related in different ways to form different systems. As a simple example of all this, one might point out that radio parts cannot be used to make an automobile, but they can be used to make both receivers and transmitters.

G.S.T. has little to say in general about the objects which make up systems, since these vary greatly across different applications. But it does outline several possible differences in relationships. The idea of a relationship, first, is that a change in an object is associated with or influenced by a change in another object; the connection is one of covariance or causation. Such relationships may be of two very general types: dependence and interdepen-

dence.⁷¹ Dependence is a case of one way influence or causation, where a change in object X results in a change in object Y; examples would be a regulatory relationship or von Bertalanffy's centralization. Interdependence, on the other hand, makes causation bidirectional or circular; a change in X causes a change in Y which may, in turn, cause another change in X. Examples here would be feedback processes or von Bertalanffy's concept of wholeness.⁷² Paralleling these two types of relationships are two types of trends in relationships. That is, if a system is moving towards or away from dependence or regulation, it is, respectively, integrating or disintegrating. Similarly, the same trends with regard to interdependence were noted earlier as systematization and segregation.

Finally, most general systems accounts make reference to some sort of state of balance or equilibrium amongst the objects and relationships of a system. The most useful of these statements, by Easton, defines equilibrium as a state where, if the system is undisturbed, ". . . no variable changes its position or relation with respect to the other variables."⁷³ He also notes a dynamic equilibrium where change occurs, but at a definite rate or within definite patterns or cycles. Each of these types of equilibrium may also be further classified as stable or unstable, depending, respectively, upon whether they return to their previous equilibrium point or move to a new one following a disturbance.

At this point, having outlined the foregoing systems concepts, the question of their relevance to the study of international relations must be faced. As a beginning step in this direction, we may paraphrase an earlier point and define an international system as a set of nation-states together with relationships between them and between their attributes. That is, by means of relationships, nations cause changes in other nations and their attributes. These relationships will be of the dependent and interdependent sorts already noted, but they may also be subdivided on the basis of their source and their intention. Source, in this case, merely refers to the rather traditional distinction between governmental and non-governmental relationships. Intention, on the other hand, refers to the predominantly, but not exclusively, human fact of purpose. Relationships or actor effects may be quite accidental or they may result from deliberate action; in the latter case, the effect produced may be that intended or some other, unintended one.

The means of international relationships, the actual linkages between nations, are of three and one-half types: perceptual, information, economic and physical. For the first, nations, like individuals, must be aware of each other as a necessary precondition to more complex interactions. Technically, this involves some transfer of information and so might be included in the second category. But it seems convenient for present purposes to retain it as a half type covering the accidental transfer of information,

thereby leaving the second category to deal with deliberate or purposive transfers. Information, it might be noted, is used here in the same non-technical sense that Deutsch uses. It includes, therefore, any fact or theory which men or nations might conceivably wish to verbalize; it most definitely subsumes the cultural and ideological facets of international life. It also includes the knowledge of economic activity but not the fact of it. This latter refers to the human and national activities of exchanging goods and services or, in short, trade. Finally, individuals and nations interact and establish physical relationships; we make love and we fight. While nations have not acquired the former habit, they most definitely have the latter.

Perceptual relationships or effects have just been defined as accidental or non-purposive information linkages between states; it might be noted, though, that nations might act deliberately through other relationships to create such effects. A better term for the same phenomena would be the currently popular 'demonstration effect,' whereby acts or situations, by their very occurrence, may result in changes in others. The foremost examples here are the suggested effects of the Czech liberalization program and the Vietnam war and the Russian and American attempts to produce opposite effects by stopping each one. A less obvious, but more important, example is the desire of most of the Afro-Asian states to emulate the West; though essentially a dependent relationship, this contact has had minor reverse

or interdependent effects as some Eastern ideas, such as Zen Buddhism, are picked up in the West. At a less auspicious level, any arms race provides a further example here, since the information upon which these are based would hardly be used deliberately for the very reason of this effect. All of this, then, establishes the perceptual relationship as one of considerable importance. Whether in the short run, through such events as arms races, or the long run, through cultural diffusion, it is a factor to be reckoned with in international relations.

The deliberate use of information or knowledge may create just as effective a relationship as that just outlined. Just as national governments manipulate symbols of legitimacy to maintain a dependent regulatory relationship, so too a major power may use ideological symbols to create or maintain a dependent alliance situation; the use of the democratic-anti-communist ideology by the U.S., and the role of the U.S. Information Agency, might be cited as examples here. In a less structured sense, the government of Charles de Gaulle has sought to exploit the French 'cultural fact' in various countries, Canada included, for effects and purposes as yet unknown. Information relationships may also be set up and used informally. For instance, the high level American technology has been used deliberately to penetrate the Canadian and European economies so as to form a dependent economic relationship; this penetration has also had the presumably unintended effect of making the countries

involved rather self-conscious about their national sovereignty. Another unintended information effect has been the strengthening of the position of the under-developed countries and the consequent lessening of their dependence on the U.S. and the U.S.S.R. as a result of the latter pair's ideological struggles.

Economic relationships have traditionally been of an informal nature, but this has been changing recently in response both to changes in nations and in other international relationships. The creation of state trading in the Communist states and of state owned corporations, such as British Petroleum, in the West, as well as the use of such things as development loans and government trade credits, have all been instrumental in bringing governments into this area. In spite of all this, though, the role of the private sector remains significant. Like all other relationships, the economic ones may be either dependent or interdependent; the extent to which a specific relationship is one or the other of these will depend upon the level of activity internationally relative to the size of the domestic economy, upon the nature of exchanges carried out and upon the nature and sophistication of domestic production. To a certain extent, however, all international trade creates dependency, since it normally results in specialization and a structuring of the domestic economy which is unrealistic in terms of domestic needs. A change in world markets may result in severe dislocations when a slower moving domestic economy cannot

keep up. All international trade, then, is a hostage given up to a foreign fortune which may not always be good.

The final type, international military relationships, is rather simple and hardly needs examples to illustrate it. Physical violence, whether used to initiate or to maintain effects, is always aimed at a dependent relationship; an interdependent one would be war and thus of relatively short duration. It is also almost entirely formal, the occasional bandit raid across national boundaries providing the only informal exceptions. Finally, its unintended effects are legion: starvation, disease, dislocation of families and so on ad absurdum.

In principle and to some extent in practice, it should be possible to apply the concepts outlined and illustrated in the preceding pages to any set of nations from a dyad to the full world set of more than one hundred now existing. The result of this would be a mapping of relationships which would define the system of the particular set chosen. Again in principle, it might be possible to add a time variable or historical dimension, thereby opening the possibility of trend studies, or to measure even roughly the relative effects of different relationships and thereby compute equilibria. Going further afield, the effects of different types of relationships on each other, the comparison of different systems and the relations between national attributes and international relationships are just a few of the conceivable topics for future investigation.

The words 'in principle' and 'possible' are stressed here for the simple reason that the crude model outlined is inadequate for the sort of tasks suggested. It is reasonably simple to abstract from events the type of general relationship used as examples here; it is a much more difficult task to abstract, classify and interpret the day to day events which make up the primary data of international relations. For this, it might be necessary to redefine and possibly supplement the categories already introduced. In any event, these are mundane and relatively surmountable problems in comparison to those of measuring the effects of interactions. As any student of comparative politics can point out, nations are not unitary phenomena with ready made attributes measurable in some convenient metric. Rather, they are complex sets of interactions which have defied adequate theoretical generalization and which have only been measured in certain narrow areas. In the absence of such theories and measures, any attempt at assessment or comparison of systems or relationships will necessarily remain at a simple and intuitive level.

In concluding this section, it might now be useful to relate its ideas to those of the earlier discussed writers on international systems. Of these, it is closest to Merritt, from whom it differs mainly by virtue of a more extensive classification of relationships and the addition of a category for physical contact. It also has significant overlap with Brams, Russett and some of Deutsch's ideas. It parts

company with Kaplan and Rosecrance by its emphasis on interactions or relationships rather than actors and it has almost no contact with the allocative or decision-making ideas set out by Easton, Spiro and Deutsch. In the latter connection, a regulatory function could easily be built into the present model, but there is little purpose in doing so. Regulation as one set object controlling a system has no important correspondent in international relations; alternatively, regulation as several objects within a system trying to control the system, as suggested by Kaplan and Rosecrance, has real life parallels, but cannot usefully be considered regulation, since it creates as many disturbances as it settles.

The present section, then, has outlined at a crude level an approach to international systems which might usefully serve to supplement the ideas of others. Its inadequacies stem partly from too short and rapid a development and partly from problems inherent in its subject matter. Its major rationalization, however, is the simple fact that it was brought forth to suggest ideas rather than to define solutions, an approach which will be carried into the next section on systems explanations.

Systems Explanations

In the section on systems explanations in Chapter Two, it was noted that little has been done in international relations in the directions of suggesting possible systemic vari-

ables for explanatory use or in testing such variables. The present section will seek to remedy the first of these complaints; it will do so not by piecemeal generation of specific examples, but by borrowing a complete abstract framework and using it to suggest future possibilities. The range of choice in this borrowing is rather limited, since it amounts to two such outlines. Singer, working within international relations, has suggested a three part categorization of properties for each level of analysis between the individual and the system.⁷⁴ A system may have structural attributes, such as size or composition, behavioural attributes, such as economic activity or military aggressiveness, and relational attributes, such as economic interdependence or ethnic similarity. The second choice is Lazarsfeld's abstract categorization of the properties of collectives and individuals for use in the social sciences generally.⁷⁵ This second possibility, which, as will be seen, is broader than and can subsume Singer's ideas, will be the one adopted here, in view of its greater generating capabilities.

Lazarsfeld first outlines three types of properties or attributes of collectives or elements made up of individual members. Analytical properties are those arrived at by performing a mathematical operation on a property of each member of the collective; these would include most statistical operations. Gross world per capita income, average world per capita income and standard deviations of world

income would all be examples of these properties in a global system. Structural properties are obtained by performing the same sorts of math operations on the relations of each member to some or all of its fellows in the collective. In effect, this is a more precisely defined version of the structural attribute Singer mentions. The aggregation for an entire system of any of the relationships mentioned in the preceding section would be illustrative here, as would a regional development indice based on Brams' transaction flows. The last type of collective property, the global, is any which does not refer to the properties of the members of the collective; it is, in effect, an emergent property. The existence of a world government as well as Waltz's absence of such a government are both relevant here, as are Singer's system behavioural variables.

Following this, Lazarsfeld discusses four types of properties of individual members of collectives; in an international system usage, these would correspond to national attributes. Absolute properties are those which characterize the individual without reference to his collective. They would include such things as national income, capabilities and behaviour. Relational properties are based on the substantive relations of the individual with others in the system. Here again, an individual's position of dependence, interdependence or independence in terms of the earlier discussed relationships would be a relevant example; a specific illustration would be Canada's independence in terms

of physical violence relationships. Comparative properties are those which characterize an individual by comparing his value on a given absolute or relational property to the distribution, average or ranking of this property in the whole system. Singer's and Rummel's relational or difference variables are the application of this principle at a two nation or dyadic level; there is, however, no reason why it should be restricted to this level. A broader example might be a nation's foreign trade volume relative to average national foreign trade. Finally, a contextual property is one which characterizes an individual in terms of a property of his collective; "Canada, as a member of N.A.T.O., is an aggressor," might be a relevant example in the U.S.S.R.

Several comments relevant to this outline of properties and its use in international relations might now be raised. First, there may be some theoretical objection to the inclusion here of individual or national attributes, particularly after the emphasis laid earlier on keeping them separate from systemic factors. Of the four listed above, however, three involve relations or comparison amongst more than one actor; in short, they involve some sort of system or collective approach. They therefore become systemic factors by virtue of the fact that they fall into no other category. Since they do not seem to have been claimed or used by other approaches, they may as well rest in the systemic classification.

Second, a short note on the possibilities of using

Lazarsfeld's categories for generating new variables in international relations. In principle, the only limit to such possibilities is that of our imagination; as long as we can continue to think of new attributes and relationships, we can continue to aggregate them or apply them directly as global properties. In practice, we will likely run into the same problems of measurement raised in the previous section. Since at least three of the seven properties mentioned involve aggregation or some other mathematical manipulation, our future success is likely to be limited by the unquantified state of our data and theoretical concepts. It may in some cases be possible to proceed intuitively, but this will be at best a half measure.

Summary

This essay took upon itself the task of investigating a number of variations on the theme of systems analysis, particularly as these related to the study of international relations. In pursuit of this goal it has studied three major variants of General Systems Theory and at least twice as many approaches to the study of international systems. It has, in this last chapter, outlined some slightly different approaches to describing international systems and to the underdeveloped area of systems explanations.

The role of General Systems Theory in the development of international systems approaches has been only partially illustrated. It was noted, for example, that cybernetic

ideas have influenced in differing measures the work of Kaplan, Rosecrance and Deutsch. The secondary spread of these ideas through the works of these writers to others has also been pointed out in certain cases. But the influence of the systems idea, in both cybernetic and more general senses, upon other important authors, such as Easton and Singer, has been left implicit to this point.

The possibility of a future role for G.S.T. in the study of international systems seems undeniable. The influence it has already exerted will no doubt continue and be expanded. And having broken down the initial barriers, it seems likely that continuing development in the general area will eventually be noted in the international area. Not all of this will be equally important, of course; Miller's biological analogies and scientific information theory are two cases mentioned in this paper which seem relatively useless for international systems study. But as long as G.S.T. continues to form a pool of creative and suggestive intelligence, there will be a place for it in international systems approaches.

This, of course, assumes that international systems studies continue to be done, which seems equally inevitable. The systems approach's emphasis on the study of international relations as international interactions is a necessary and desirable complement to the national or foreign policy approach. The only thing which one cannot say for sure is what directions these future studies will take; a number

of past directions have been outlined already and each of these is likely to play a part in determining the future.

FOOTNOTES

¹Kenneth E. Boulding, "General Systems as a Point of View," in Views on General Systems Theory, ed. by Mihajlo D. Mesarovic (New York: John Wiley & Sons, Inc., 1964), p. 25.

²Anatol Rapoport, "General Systems Theory," International Encyclopedia of the Social Sciences (The Macmillan Company & The Free Press, 1968), Vol. XV, p. 452.

³Ludwig von Bertalanffy, "An Outline of General System Theory," The British Journal for the Philosophy of Science, I (August, 1950), pp. 134-65; L. von Bertalanffy, C.G. Hempel, R.E. Bass and H. Jonas, "General System Theory: A New Approach to Unity of Science," Human Biology, XXIII (December, 1951), pp. 312-61.

⁴"General System Theory -- A Critical Review," General Systems, VII (1962), p. 2.

⁵von Bertalanffy, "A Critical Review," p.2.

⁶Rapoport, pp. 452-3; von Bertalanffy, "An Outline," pp. 154-63. The present writer does not claim total accuracy for this rather superficial account, due to an inadequate background in the relevant disciplines.

⁷von Bertalanffy, "An Outline," pp. 143-54. The previous disclaimer as to accuracy applies here as well.

⁸See Arthur Koestler, The Sleepwalkers, A History of Man's Changing Vision of the Universe (Harmondsworth, Middlesex, England: Penguin Books, Ltd., 1964), pp. 344-8.

⁹von Bertalanffy, "An Outline," pp. 134-6.

¹⁰von Bertalanffy, "An Outline," pp. 136-9.

¹¹von Bertalanffy, "An Outline," p. 139.

¹²von Bertalanffy, "An Outline," p. 142.

¹³Ludwig von Bertalanffy, "General System Theory," General Systems, I (1956), pp. 8-10.

¹⁴J.O. Wisdom, "The Hypothesis of Cybernetics," General

Systems, I (1956), p. 111.

15W. Ross Ashby, An Introduction to Cybernetics (New York: Science Editions; John Wiley & Sons, Inc., 1963), pp. 53-4.

16W. Ross Ashby, "General Systems Theory as a New Discipline," General Systems, III (1958), pp. 1-6.

17W. Ross Ashby, Design for a Brain, The Origin of Adaptive Behaviour (2nd. ed.; London: Science Paperbacks, 1966), ch.'s 19-22.

18von Bertalanffy, "A Critical Review," pp. 3; 13.

19James G. Miller, "Toward a General Theory for the Behavioral Sciences," American Psychologist, X (1955); "Living Systems: Basic Concepts," Behavioral Science, X (July, 1965); "Living Systems: Structure and Process," and "Living Systems: Cross-Level Hypotheses," Behavioral Science, X (October, 1965).

20Kenneth Boulding, "General Systems Theory -- The Skeleton of Science," General Systems, I (1956), pp. 11-7.

21Boulding actually gives nine levels. His first distinguishes static frameworks for all the remaining eight levels of dynamic systems, a distinction which would be better made within each level. His last is the level of "...ultimates and absolutes and the inescapable unknowables", a level which is not of concern here.

22Miller, "Living Systems: Basic Concepts."

23Miller, "Living Systems: Structure and Process," pp. 344-8.

24Miller, "Living Systems: Structure and Process," pp. 351-60.

25Miller, "Living Systems: Structure and Process," pp. 362-78.

26Miller, "Living Systems: Cross-Level Hypotheses."

27Hans J. Morgenthau, Politics Among Nations, The Struggle for Power and Peace, (4th. ed.; New York: Alfred A. Knopf, Publisher, 1967), ch. 1.

28John H. Herz, International Politics in the Atomic Age (New York: Columbia Paperbacks; Columbia University Press, 1962).

²⁹Morgenthau, ch.'s 15, 16 and 18.

³⁰Kenneth N. Waltz, Man, the State and War, A Theoretical Analysis (New York: Columbia Paperbacks; Columbia University Press, 1965).

³¹Jay S. Goodman, "The Concept of System in International Relations Theory," Background, VIII (1965), pp. 257-68. Goodman also includes a third category, system-as-method, which covers those uses of system which are based on or borrow from a non-international relations set of concepts, such as G.S.T. or games theory. It does not seem a useful category, first, because of the indiscriminate way it lumps together a great variety of widely different concepts and, second, because in the case of G.S.T., it is almost impossible to judge the source of any given applied idea.

³²(New York: Science Editions; John Wiley & Sons, Inc., 1964).

³³Kaplan, pp. 12-14; 19.

³⁴His use of positive feedback on pages 31 and 33 is uncertain; his use of equilibrium on page 26 is incomprehensible.

³⁵Kaplan, p. 89.

³⁶For examples, see Kaplan, pp. 115-17.

³⁷Kaplan, p. 115.

³⁸K. E. Boulding, "Theoretical Systems and Political Realities," review of System and Process in International Politics, by Morton A. Kaplan, in the Journal of Conflict Resolution, II (December, 1958), p. 334.

³⁹Roger D. Masters, "A Multi-bloc Model of the International System," American Political Science Review, LV (1961), pp. 780-98.

⁴⁰Wolfram F. Hanrieder, "The International System: Bipolar or Multi-bloc?," Journal of Conflict Resolution, IX (September, 1965).

⁴¹Richard L. Merritt, "Systems and the Disintegration of Empire," General Systems, VIII (1963), pp. 91-103. Technically, the system which Merritt describes is a subsystem of the greater European system of the time, but the model which he develops could conceivably have whole system applications.

⁴²See Kaplan's bipolar system rules, pp. 38-39.

⁴³Richard N. Rosecrance, Action and Reaction in World Politics (Boston: Little, Brown and Company, 1963).

⁴⁴Rosecrance, pp. 220-32.

⁴⁵David Easton, A Systems Analysis of Political Life (New York: John Wiley & Sons, Inc., 1965), pp. 484-88.

⁴⁶David Easton, A Framework for Political Analysis (Englewood Cliffs, N.J.: Prentic-Hall, Inc., 1965), ch. 6, especially pp. 77-78.

⁴⁷Herbert J. Spiro, World Politics: The Global System (Homewood, Illinois: The Dorsey Press, 1966).

⁴⁸Spiro, pp. 53-54.

⁴⁹Spiro's understanding of system theory is at best unusual: for example, his view of the political system as archetype for all systems theory and as superior, rather than coexistent and equal, to all other social systems. See Herbert J. Spiro, "An Evaluation of Systems Theory," in Contemporary Political Analysis, ed. by James C. Charlesworth (New York: The Free Press, 1967), pp. 164-74.

⁵⁰Leonard Binder, "The Middle East as a Subordinate International System," World Politics, X (April, 1958), pp. 408-29.

⁵¹Michael Brecher, "International Relations and Asian Studies, The Subordinate State System of Southern Asia," World Politics, XV (January, 1963), pp. 213-35.

⁵²Oran R. Young, "Political Discontinuities in the International System," World Politics, XX (April, 1968), pp. 369-92.

⁵³The issue area approach referred to here has been central to most of Rosenau's recent theorizing. For some varying accounts, see James N. Rosenau, "The Functioning of International Systems," Background, VII (1963), pp. 111-18; "Pre-theories and Theories of Foreign Policy," in Approaches to Comparative and International Politics, ed. by R. Barry Farrell (Evanston: Northwestern University Press, 1966), pp. 27-92.

⁵⁴Rosenau, "Pre-theories," p. 74n.

⁵⁵Rosenau, "Pre-theories," pp. 82-83.

⁵⁶Bruce M. Russett, International Regions and the

International System, A Study in Political Ecology (Chicago: Rand McNally & Company, 1967). For a briefer summary of some of the same data, see Bruce M. Russett, "Delineating International Regions," in Quantitative International Politics: Insights and Evidence, ed. by J. David Singer (New York: The Free Press, 1968), pp. 317-52.

⁵⁷Rudolph J. Rummel, "The Dimensionality of Nations Project," in Comparing Nations, The Use of Quantitative Data in Cross-National Research, ed. by Richard L. Merritt and Stein Rokkan (New Haven: Yale University Press, 1966), pp. 109-29.

⁵⁸Karl W. Deutsch, The Nerves of Government, Models of Political Communication and Control (New York: The Free Press, 1966). A much shorter survey of his ideas is given in Karl W. Deutsch, "Communication Models and Decision Systems," in Charlesworth, pp. 273-99.

⁵⁹Steven J. Brams, "Transaction Flows in the International System," American Political Science Review, LX December, 1966), pp. 880-98.

⁶⁰From his "Applications of General Systems Theory in International Relations," in International Politics and Foreign Policy, A Reader in Research and Theory, ed. by James N. Rosenau (New York: The Free Press, 1961), pp. 412-21, to his "Driving Out the Hollowness: The Reshaping of International Systems Theory," University of Southern California, 1968 (mimeo).

⁶¹See Charles A. McClelland, "The Acute International Crisis," in The International System, Theoretical Essays, ed. by Klaus Knorr and Sidney Verba (Princeton, N.J.: Princeton University Press, 1961), pp. 182-204, and Theory and the International System (New York: The Macmillan Company, 1966), pp. 103-07.

⁶²The latter idea of relating a crisis subsystem to a more broad system seems to be a recent addition to McClelland's ideas. See his "Access to Berlin: The Quantity and Variety of Events, 1948-1963," in Singer, pp. 159-86; see especially pp. 160-63.

⁶³McClelland, "Access to Berlin."

⁶⁴This, of course, is Waltz's third image. See Waltz, ch.'s 6 and 7.

⁶⁵Kaplan, ch. 2.

⁶⁶Karl W. Deutsch and J. David Singer, "Multipolar Power Systems and International Stability," World Politics,

XVI (April, 1964), pp. 390-406.

⁶⁷J. David Singer and Melvin Small, "Alliance Aggregation and the Onset of War, 1815-1945," in Singer, pp. 247-86.

⁶⁸Supra., pp. 31-2; 40.

⁶⁹Russett, International Regions and the International System, ch. 12.

⁷⁰A. D. Hall and R. E. Fagen, "Definition of System," General Systems, I (1956), p. 18.

⁷¹A third variety of 'dependence,' independence, is obviously not relevant here, since it means no relationship and thus no system.

⁷²The purist may note some subtle changes in the meanings of terms used here from those given in Chapter One. Regulation, particularly, was earlier defined as an interdependent, feedback relationship rather than as a dependent one. Technically, the prior usage is the correct one, since any ongoing regulatory body requires a feedback of information on the state of the variable being controlled. Nonetheless, the present usage seems acceptable, since it refers only to the direction of influence or causation. In this, the values taken by the regulated variable are totally dependent upon those of the regulator.

⁷³David Easton, "Limits of the Equilibrium Model in Social Research," Behavioral Science, I (1956), pp. 96-104.

⁷⁴Singer and Small, pp. 247-48.

⁷⁵Paul F. Lazarsfeld, "Evidence and Inference in Social Research," in Evidence and Inference, ed. by Daniel Lerner (Glencoe, Ill.: The Free Press, 1958), pp. 107-38. The section referred to here is on pp. 117-25.

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